NOTE: Refer to the Supplement at the back of this manual for information unique to 2006-on models.

CHAPTER FIVE

ENGINE LOWER END

This chapter describes service procedures for the lower end components.

The following components can be serviced with the engine mounted in the frame:

1. Cylinder head.
2. Cylinder and piston.
3. Clutch.
4. Oil pump.
5. Oil cooler.
6. Carburetor.
7. Alternator.

The text frequently mentions the front and rear sides of the engine. These terms refer to the engine in the vehicle's frame, not how it may sit on the workbench.

When inspecting lower end components, compare measurements to the engine lower end specifications in **Table 1**. Replace any component that is damaged, worn to the service limit or out of specification. During assembly, tighten fasteners to the torque specifications. **Table 1** and **Table 2** are at the end of this chapter.

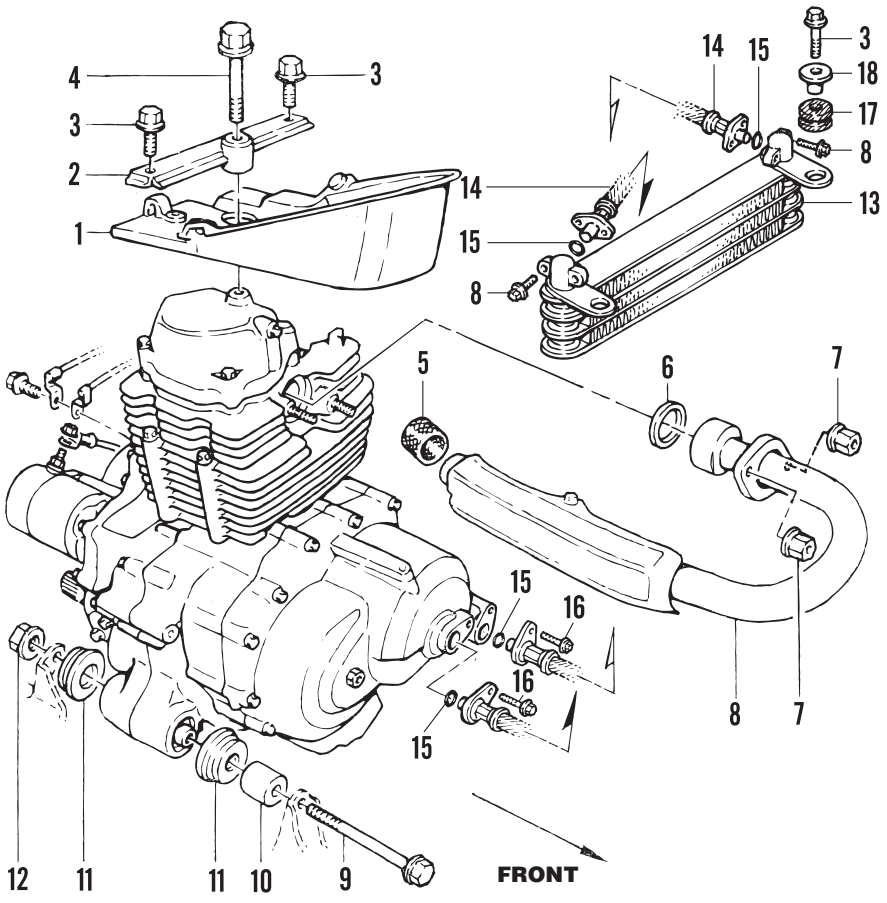
ENGINE REMOVAL/INSTALLATION

Refer to **Figure 1**.

1. Park the vehicle on a level surface and set the parking brake.
2. Drain the engine oil as described in Chapter Three.
3. Remove the seat, both side covers, front fender and rear mudguards as described in Chapter Fourteen.
4. Disconnect the negative battery cable (**Figure 2**).
5. Remove the fuel tank and heat guard as described in Chapter Eight.
6. Remove the air box, carburetor and exhaust pipe as described in Chapter Eight.
7. Remove the spark plug cap.
8. Remove the cable (**Figure 3**) from the starter.
9. Remove the bolt (A, **Figure 4**) and disconnect the two ground cables (B) from the crankcase.
10. Disconnect the 3-pin alternator connector (A, **Figure 5**) and the 2-pin pulse generator connector (B).
11. Loosen the clamp bolt and remove the shift pedal (**Figure 6**) from the gearshift spindle. Note that the punch mark on the pedal aligns with the mark on the spindle. These marks must align during assembly.
12. Disconnect the crankcase breather hose (**Figure 7**) from the port on the crankcase.

1

ENGINE REMOVAL



1. Heat guard
2. Cross member
3. Bolt
4. Cylinder head cover mounting bolt
5. Muffler gasket
6. Exhaust pipe gasket
7. Exhaust pipe nut
8. Exhaust pipe
9. Lower engine mounting bolt
10. Collar
11. Damping rubber
12. Engine mounting bolt
13. Oil cooler
14. Oil cooler hose
15. O-ring
16. Bolt
17. Mounting grommet
18. Mounting collar

13. Loosen the clamp bolt (**Figure 8**) on the swing arm boot.

14. On the left side of the alternator cover, remove the mounting bolts (A, **Figure 9**) and remove the cover (B) from the reverse stopper lever.

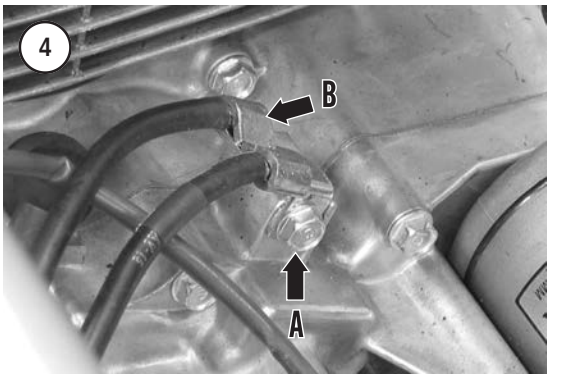
15. Remove the cable bracket mounting bolt (C, **Figure 9**), and disconnect the reverse selector cable from the reverse stopper lever (A, **Figure 10**).

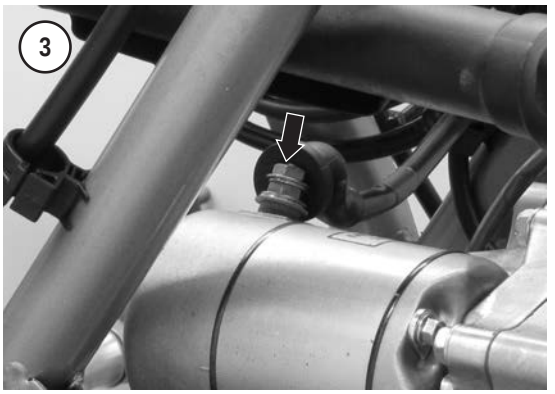
16. Disconnect the electrical connectors.

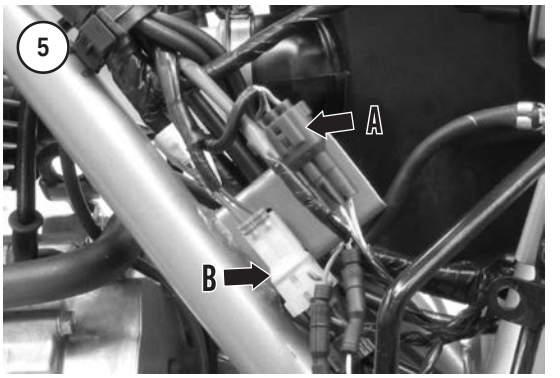
a. On 2001-2002 models, disconnect the reverse switch connector (B, **Figure 10**) and the neutral switch connector (C) directly from the externally mounted switches (**Figure 11**).

b. On 2003-on models, disconnect the reverse and neutral switch connector from the switches mounted inside the alternator cover.

17. Place a jack under the engine and support the engine to remove tension from the lower engine







hanger mounting bolts. Place a block of wood between the jack pad and engine to protect the crankcase.

18. Remove the cylinder head cover mounting bolt.

19. Remove the right lower engine mounting nut (A, **Figure 12**). Pull the engine hanger bolt (B, **Figure 12**) from the mount, and remove the collar (C) and both damping rubber (D).

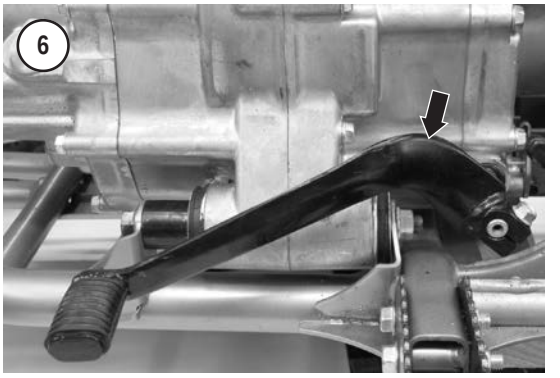
20. Remove the left lower engine mounting nut (A, **Figure 13**). Remove the hanger bolt (B, **Figure 13**) from the mount, and remove the collar (C) and both damping rubber (D).

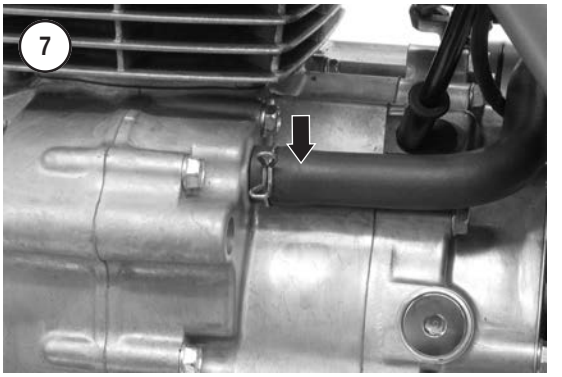
WARNING

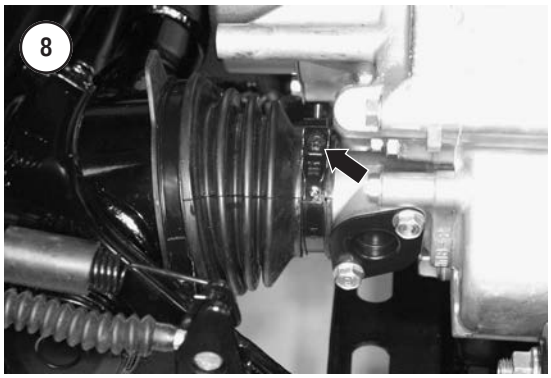
If removing an assembled engine, the following steps requires the aid of a helper to remove the engine from the frame.

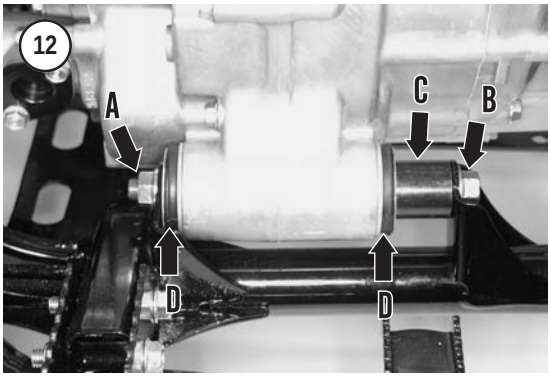
21. Move the engine forward and disconnect the countershaft from the universal joint. Remove the engine from the left side of the frame. Support the engine on a workbench.

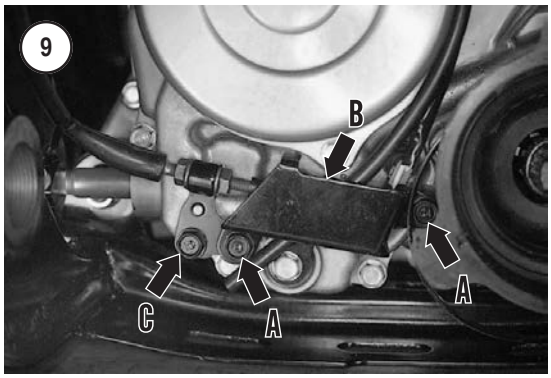
22. Install the engine in the frame by reversing these steps. Note the following:

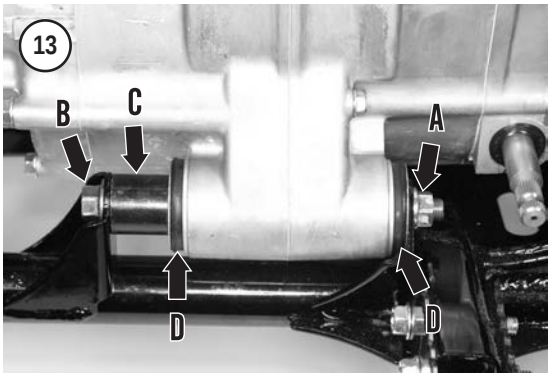


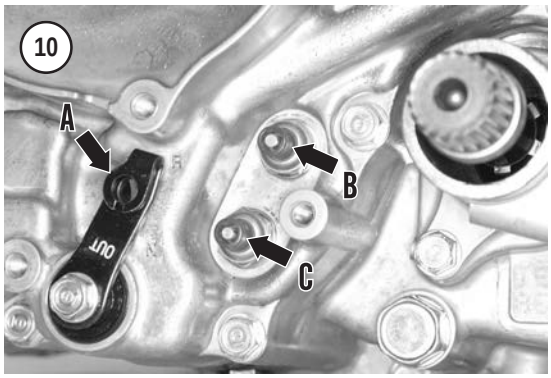


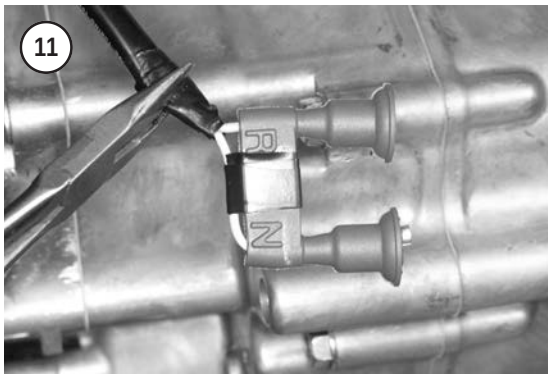












a. Replace damaged engine mount fasteners.

b. Apply an antiseize compound to the shoulders on each engine mount bolt. This helps to prevent rust and corrosion.

c. Lubricate the universal joint and countershaft splines with molybdenum disulfide grease.

d. Make sure the damping rubber is in place on each side of the hanger bushings (**Figure 14**). The larger diameter end must face in (11, **Figure 1**).

5

e. Tighten the lower engine mounting nuts (A, **Figure 12** and A, **Figure 13**) to 54 N•m (40 ft.-lb.).
f. Tighten the cylinder head cover mounting bolt to 32 N•m (24 ft.-lb.).
g. When installing the shift pedal, align the punch mark on the shift pedal with the mark on the gearshift spindle. Tighten the shift pedal clamp bolt to 18 N•m (13 ft.-lb.).
h. Check the electrical connectors for corrosion. Pack the connectors with dielectric grease before reconnecting them.
i. Fill the engine with the recommended type and quantity of oil. Refer to Chapter Three.
j. Check the throttle operation. If necessary, adjust the throttle cable as described in Chapter Three.
k. Adjust the reverse selector cable as described in Chapter Three.

OIL COOLER

The oil cooler plays an important role in maintaining the engine temperature within acceptable limits. Keep the oil cooler fins clean and straight so airflow can remove excess engine heat.

Removal/Installation

1. Drain the engine oil as described in Chapter Three.

2A. If the engine is being removed, disconnect the oil cooler hoses (**Figure 15**) from the clutch cover.

2B. If only removing the oil cooler, disconnect the oil cooler hoses from the oil cooler. Remove the joint bolts that secure each pipe (A, **Figure 16**).

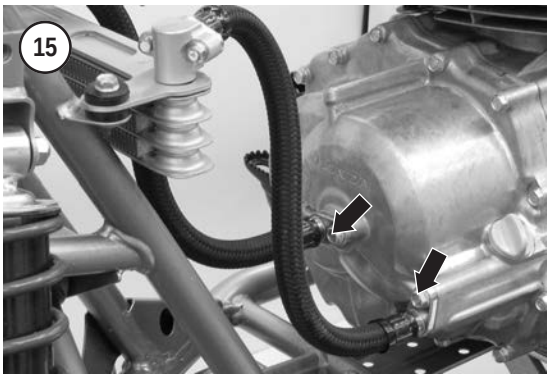
3. Remove the O-ring from the joint at the pipe fittings.

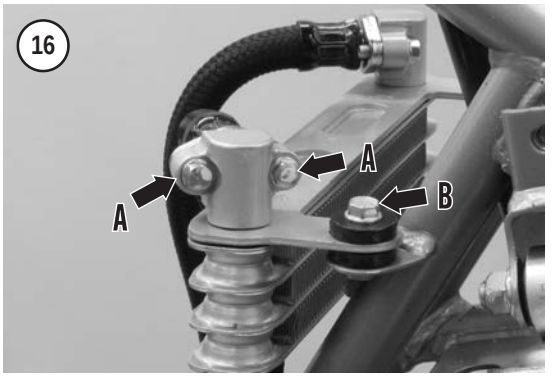
4. Remove the mounting bolts (B, **Figure 16**) that secure the oil cooler.

5. Inspect the oil cooler as described in this section.

6. Reverse this procedure to install the oil cooler, and observe the following:

a. Install *new*, lubricated O-rings in the oil pipe connections (**Figure 17**).
b. After refilling with oil, start the engine and check all its fittings for leaks.





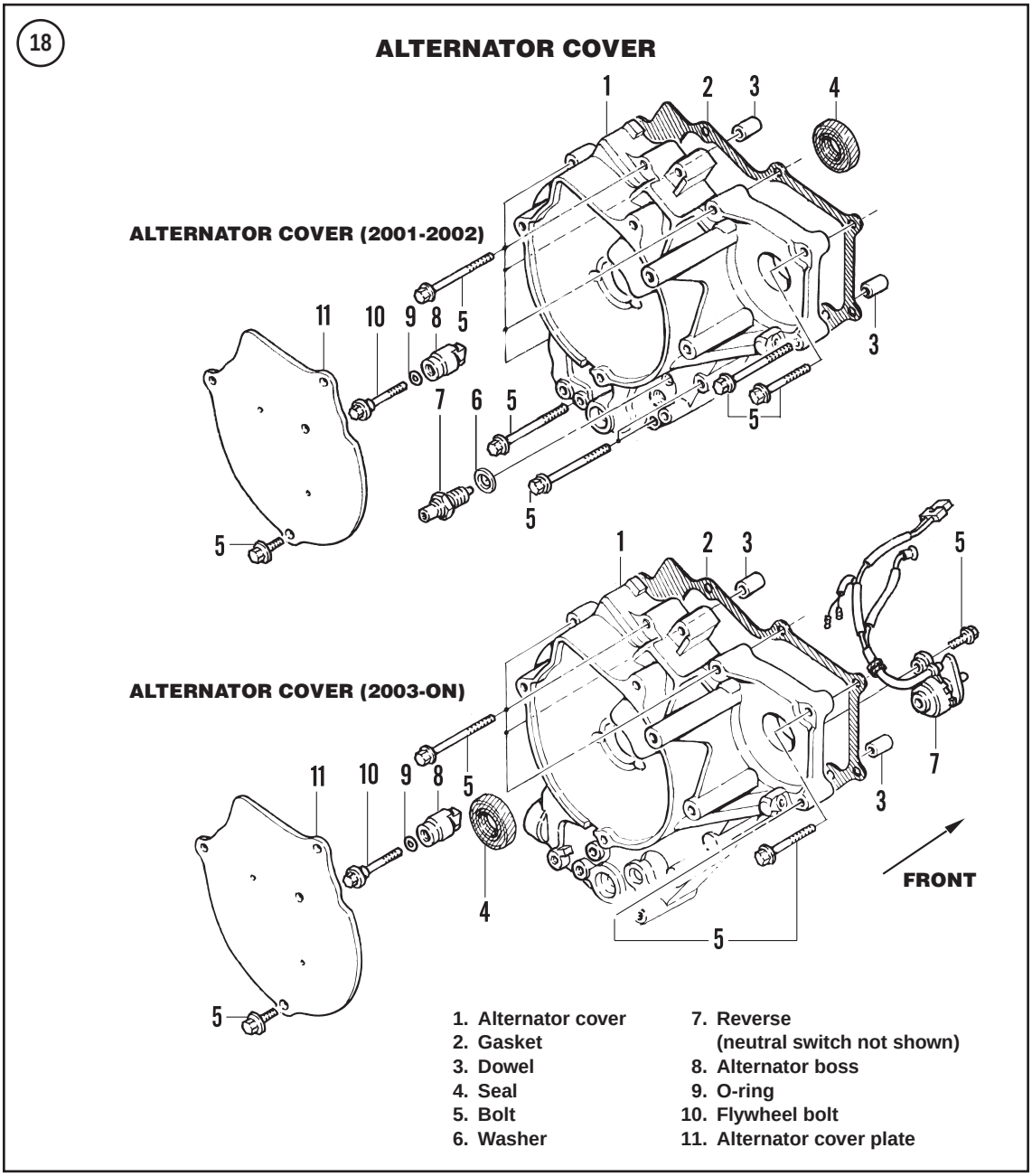
Inspection

1. Drain any remaining oil out of the oil cooler. Cover the oil cooler inlet and outlet holes to prevent the entry of dirt during the cleaning and inspection procedure.

2. Blow all debris from the cooling fins, and then wipe the oil cooler clean.

3. Inspect the cooling fins for damage. Straighten bent fins with a flat-blade screwdriver.

4. Inspect the oil cooler for pin holes and cracks. If damage is evident, take the oil cooler to a dealership



or radiator shop to see if repairs are possible. If not, replace the oil cooler.

5. Blow through the oil cooler inlet to check for plugging. If plugging is evident or suspected, take the oil cooler to a dealership or radiator repair shop to see if cleaning is possible. If not, replace the oil cooler.

6. Install the oil cooler as described in this section.

ALTERNATOR COVER

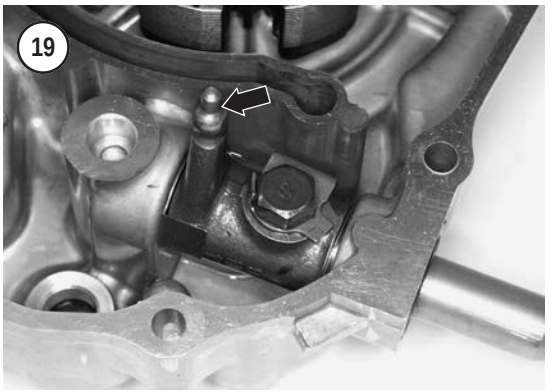
There are two different alternator covers (**Figure 18**). The 2001-2002 model covers have the neutral and reverse switches mounted externally. The 2003-on models have a combined reverse/neutral switch mounted internally to the inside of the cover. Both switches are tested the same.

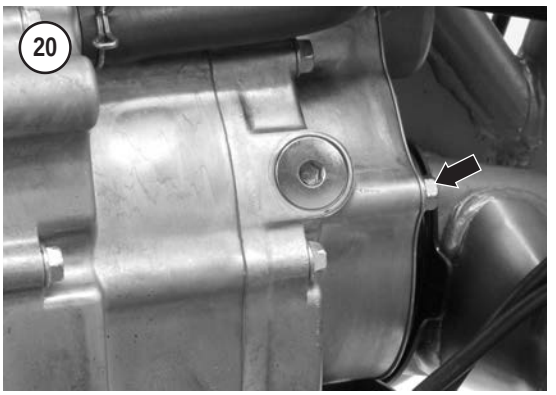
The following components are mounted to the alternator cover:

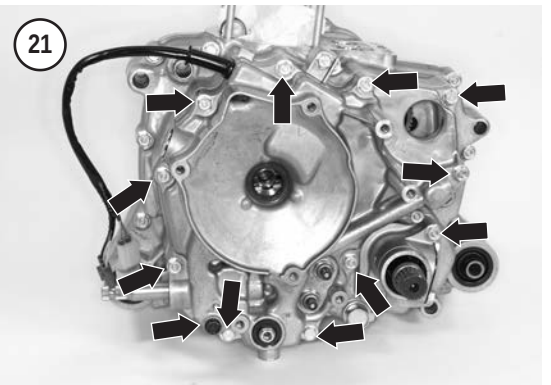
1. Ignition pulse generator/stator assembly.
2. Neutral and reverse switches.
3. Gearshift A-arm/gearshift spindle assembly (**Figure 19**).
4. Reverse stopper lever.

Removal

1. If the engine is mounted in the frame, perform the following:
   a. Remove the seat, side covers and rear mudguards as described in Chapter Fourteen.
   b. Disconnect the negative battery cable as described in Chapter Three.
   c. Drain the engine oil as described in Chapter Three.
   d. Remove the oil cooler as described in this chapter.
   e. Remove the starter as described in Chapter Nine.
   f. Remove the bolt (A, **Figure 4**) and disconnect the two ground cables (B) from the crankcase.
   g. Disconnect the 3-pin alternator connector (A, **Figure 5**) and the 2-pin pulse generator connector (B).
   h. Loosen the clamp bolt and remove the shift pedal (**Figure 6**) from the gearshift spindle. Note that the punch mark on the pedal aligns with the mark on the spindle. These marks must align during assembly.
   i. On the left side of the alternator cover, remove the mounting bolts (A, **Figure 9**) and cover (B) from the reverse stopper lever.
   j. Remove the cable bracket mounting bolt (C, **Figure 9**), and disconnect the reverse selector cable from the reverse stopper lever (A, **Figure 10**).
   k. Remove the mounting bolt and remove the reverse stopper lever (A, **Figure 10**) from the reverse stopper shaft.
   l. Disconnect the electrical connectors.
   m. On 2001-2002 models, disconnect the reverse switch connector (B, **Figure 10**) and the neutral switch connector (C) directly from the externally mounted switches (**Figure 11**).

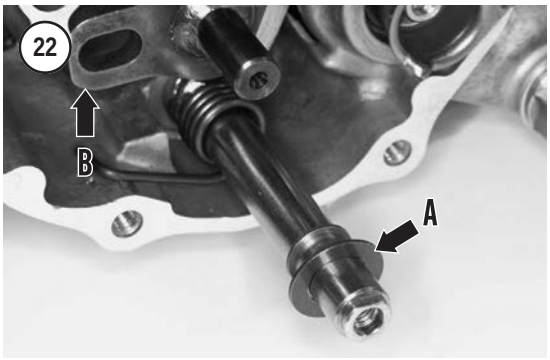


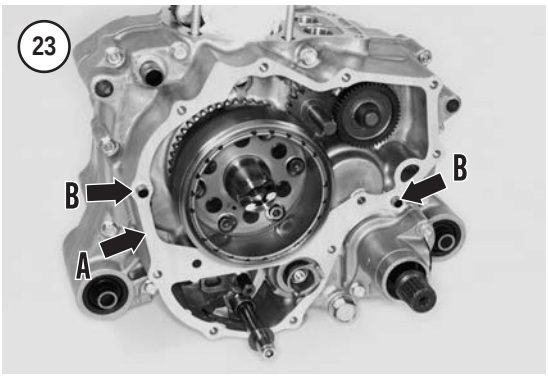




   n. On 2003-on models, disconnect the reverse and neutral switch connector from the switches mounted inside the alternator cover.

2. Remove the three bolts (**Figure 20**) that secure the flywheel bolt plate cover.
3. Remove the alternator cover bolts (**Figure 21**) and the alternator cover. Do not lose the washer (A, **Figure 22**) from the end of the reverse stopper shaft.
4. Remove the alternator cover gasket (A, **Figure 23**) and the dowels (B).





Installation

CAUTION

The flywheel must be properly seated on the crankshaft taper. If it is not, the magnetic force pulls the flywheel off the taper when the alternator cover is installed.

1. Seat the flywheel onto the crankshaft by performing the following:
   a. Apply oil to the O-ring, threads of the flywheel bolt, and bolt flange. Install the bolt into the crankshaft.
   b. Hold the flywheel with a strap wrench, and tighten the flywheel bolt (**Figure 24**) to 74 N•m (54 ft.-lb.).
   c. Remove the flywheel bolt from the crankshaft.
2. Install the two dowels (B, **Figure 23**) and a new alternator cover gasket (A) onto the crankcase.
3. Check that the washer (A, **Figure 22**) is in place on the reverse stopper shaft.

NOTE

*The pin on the gearshift A-arm (**Figure 19**) must engage the slot in the sub-gearshift spindle (B, **Figure 22**). The transmission cannot be shifted if these parts do not properly engage.*

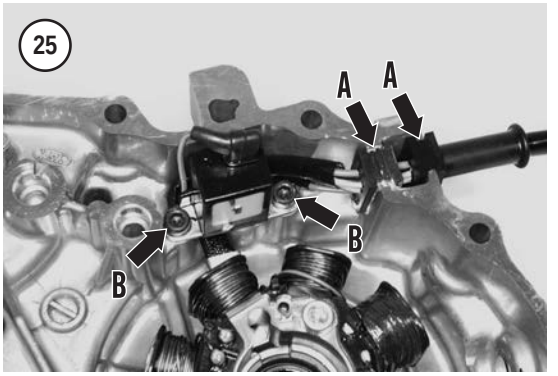
4. Align the pin on the gearshift A-arm (**Figure 19**) with the slot in the sub-gearshift spindle (B, **Figure 22**), and fit the alternator cover into place on the crankcase.
5. Install the alternator cover bolts (**Figure 21**). Evenly tighten the bolts in a crisscross pattern.
6. Set the reverse stopper lever (A, **Figure 10**) onto the reverse stopper shaft so the OUT on the lever faces away from the crankcase. Install the mounting bolt, and tighten it securely.
7. Once the cover is in place, perform the following:
   a. Check the gearshift linkage engagement by turning the gearshift spindle. Turning play should be minimal. If play is noted, the engagement was probably not made. Confirm this by installing the shift pedal onto the gearshift spindle, and then try to shift the transmission. If the engine is out of the frame, turn the countershaft while shifting. If the engine is in the frame and connected to the drive shaft, support the vehicle with the rear wheels off the ground and turn the rear wheels while shifting.
   b. Move the reverse stopper lever by hand. The reverse stopper shaft should engage and disengage its groove in the shift drum.
   c. If either linkage is not working correctly, remove the alternator cover and correct the problem.
8. Install the flywheel bolt and tighten to 74 N•m (54 in.-lb.).
9. If the engine is installed in the frame, perform the following:

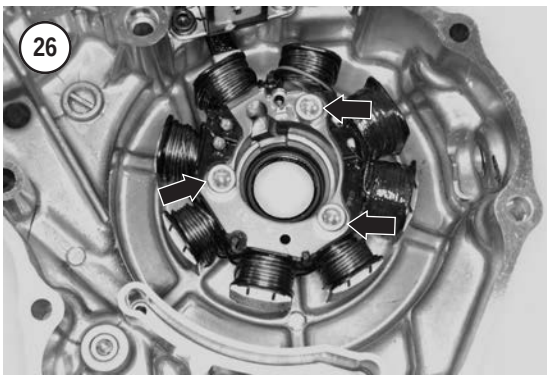
a. Connect the electrical connectors (**Figure 11**) to the reverse switch (B, **Figure 10**) and the neutral switch (C) on the left side of the alternator cover.
b. Connect the reverse selector cable to the reverse stopper lever (A, **Figure 10**), and secure the cable bracket in place with the mounting bolt (C, **Figure 9**).
c. Place the cover (B, **Figure 9**) over the reverse stopper lever, and secure it in place with the mounting bolts (A).
d. Install the shift pedal onto the gearshift spindle. Make sure the punch mark on the pedal aligns with the mark on the spindle, and tighten the shift pedal clamp bolt to 20 N•m (14 ft.-lb.).
e. Connect the 3-pin alternator connector (A, **Figure 5**) and the 2-pin pulse generator connector (B) to their mates on wiring harness.
f. Secure the two ground cables (B, **Figure 4**) to the crankcase with the mounting bolt (A).
g. Install the starter as described in Chapter Nine.
h. Add engine oil as described in Chapter Three.
i. Connect the negative battery cable as described in Chapter Three.
j. Install the seat and side covers as described in Chapter Fourteen.

Disassembly/Assembly

Perform these steps to remove the ignition pulse generator/stator assembly from the alternator cover.

1. Note how the alternator cable is routed through the cover. It must be rerouted along the same path during assembly.
2. Lift the alternator cable, and remove the grommets (A, **Figure 25**) from the alternator cover.
3. Remove the ignition pulse generator mounting bolts (B, **Figure 25**).
4. Remove the stator mounting bolts (**Figure 26**).
5. Lift the ignition pulse generator/stator assembly from the cover, and remove the ignition pulse generator/stator assembly..
6. Assembly is the reverse of disassembly. Note the following:
   a. Apply ThreeBond 1342, or its equivalent, to the threads of the ignition pulse generator bolts. Tighten the bolts to 6 N•m (53 in.-lb.).





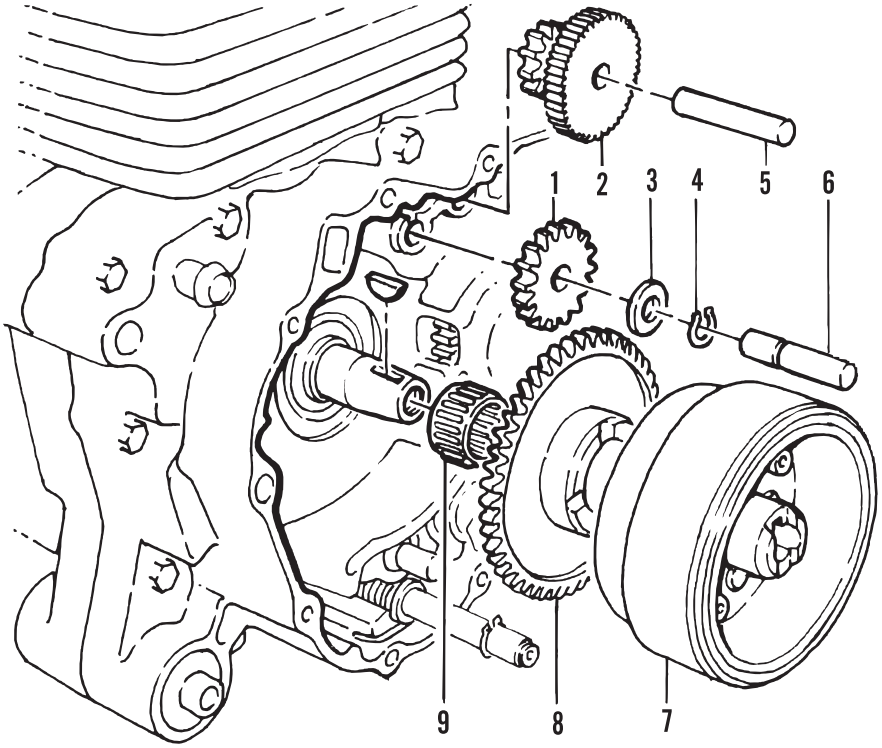
   b. Apply a non-hardening sealant to the cable grommets (A, **Figure 25**) before installing them into the alternator cover.

Oil Seal Inspection/Replacement

1. Inspect the alternator cover seal (A, **Figure 27**) and the reverse stopper shaft seal (B) for oil leaks, wear or damage.
2. Replace either seal as necessary by performing the following:

28

FLYWHEEL AND STARTER GEARS



1. Starter reduction gear C
2. Starter reduction gear A
3. Washer
4. Snap ring
5. Shaft
6. Shaft
7. Flywheel
8. Starter driven gear
9. Needle bearing

a. Pry the seal out of the cover with a seal remover. Pad the bottom of the tool to prevent it from damaging the alternator cover.

b. Pack the lips of the new seal with lithium grease.

c. Drive the seal into place with an appropriate size bearing driver or socket that matches the outside diameter of the seal. Install the seal with the manufacturer's marks facing out.

FLYWHEEL AND STARTER GEARS

This section describes service to the starter gears, flywheel and starter clutch assembly. These assemblies can be serviced with the engine installed in the frame. The engine is shown removed from the frame for clarity.

Flywheel Removal

A flywheel puller is required to remove the flywheel from the crankshaft. Use either a Honda flywheel puller (part No. 07733-0010000 or 07933-2000000) or a K&L rotor puller (part No. 35-0829).

Refer to **Figure 28**.

1. Remove the alternator cover as described in this chapter.
2. Remove the reduction gear A (**Figure 29**) and its shaft from the boss in the crankcase.
3. Remove the reduction gear C assembly (**Figure 30**) from the crankcase.

4. Slide reduction gear C (A, **Figure 31**) and its washer (B) off the shaft (C).

CAUTION

Do not remove the flywheel without a puller. Doing so damages the crankshaft and flywheel.

5. Turn the flywheel puller (**Figure 32**) into the flywheel.

CAUTION

If normal flywheel removal attempts fail, do not force the puller. Excessive force strips the flywheel threads, causing expensive damage. Take the engine to a dealership and have it remove the flywheel.

6. Hold the flywheel and gradually tighten the flywheel puller until the flywheel pops off the crankshaft taper.
7. Remove the puller from the flywheel.
8. Remove the flywheel/starter clutch assembly (**Figure 33**) from the crankshaft.
9. Remove the needle bearing (A, **Figure 34**) and the Woodruff key (B).
10. Inspect the flywheel, starter clutch and starter gears as described in this section.

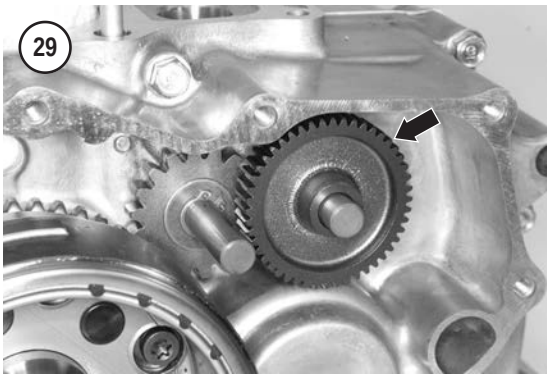
Flywheel Installation

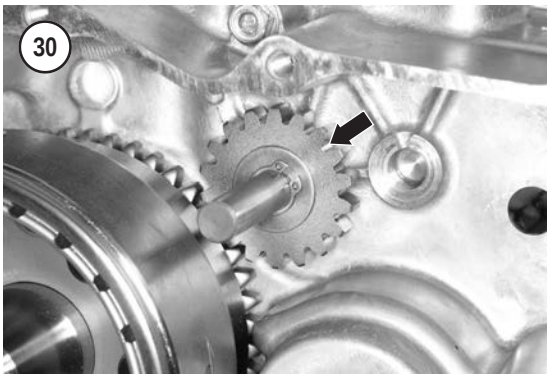
1. Clean any oil from the crankshaft taper.
2. Apply engine oil onto the needle bearing, and install the bearing (A, **Figure 34**) onto the crankshaft.
3. Seat the Woodruff key (B, **Figure 34**) into the crankshaft.
4. Align the flywheel key way with the Woodruff key in the crankshaft, and install the flywheel/starter clutch assembly (**Figure 33**).

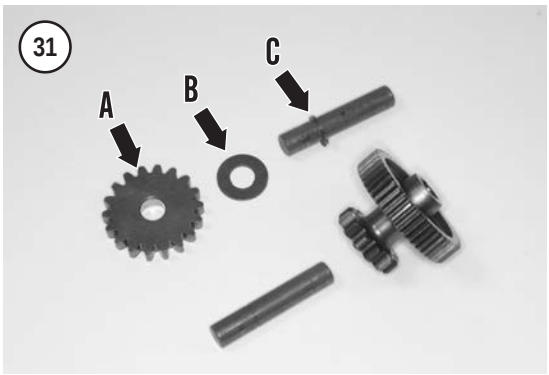
CAUTION

The flywheel must be properly seated on the crankshaft taper. If it is not, the magnetic force pulls the flywheel off the taper when the alternator cover is installed.

5. Seat the flywheel onto the crankshaft by performing the following:
   a. Apply oil to the O-ring, the threads of the alternator bolt and the bolt flange. Install the bolt into the crankshaft.



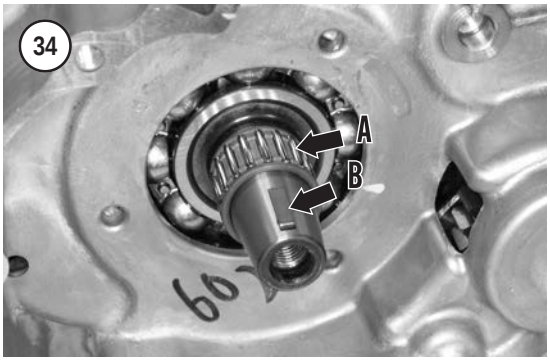




   b. Hold the flywheel with a strap wrench and tighten the bolt (**Figure 24**) to 74 N•m (54 ft.-lb.).
   c. Remove the flywheel bolt from the crankshaft.

6. Install the thrust washer (B, **Figure 31**) and reduction gear C (A) onto the shaft. Make sure the thrust washer sits against the snap ring.

7. Align the teeth of reduction gear C with the teeth of the starter driven gear, and install reduction gear C assembly into the crankcase (**Figure 30**). Make



sure the shaft is properly seated in the crankcase mounting boss.

8. Install the reduction gear A assembly (**Figure 29**) into its mounting boss in the crankcase. Make sure the teeth of the inboard gear mesh with those of reduction gear C.

9. Install the alternator cover as described in this chapter.

Flywheel Inspection

1. Clean and dry the flywheel.
2. Check the flywheel for cracks or breaks.

WARNING

Replace a cracked or chipped flywheel. A damaged flywheel can fly apart, throwing metal fragments into the engine. Do not repair a damaged flywheel.

3. Check the flywheel tapered bore and the crankshaft taper for damage.
4. Replace damaged parts as required.

5

Starter Reduction Assembly Inspection

Replace parts that show damage as described in this section.

1. Clean and dry all parts (**Figure 31**).
2. Inspect the reduction gears for the following conditions:
   a. Excessively worn or damaged gear teeth.
   b. Excessively worn or damaged bearing surfaces.
3. Inspect the reduction gear shafts for excessive wear.
4. Check the snap ring in the shaft (C, **Figure 31**) for reduction gear C. If the snap ring was removed, install a new one during installation.

Starter Clutch Disassembly/Inspection/Assembly

Refer to **Figure 35**.

1. Check the one-way clutch operation by performing the following:
   a. Place the flywheel and starter clutch on the workbench so the driven gear faces up as shown in **Figure 36**.
   b. Hold the flywheel and try to turn the driven gear clockwise and then counterclockwise. The driven gear should turn counterclockwise but not clockwise.
   c. If the driven gear turns clockwise, the one-way clutch is damaged and must be replaced.
2. Rotate the driven gear (**Figure 36**) counterclockwise while pulling up, and remove the driven gear from the starter clutch.
3. Inspect the driven gear for the following conditions:
   a. Worn or damaged gear teeth (A, **Figure 37**).

b. Worn or damaged bearing shoulder (B, **Figure 37**).

4. Inspect the needle bearing (C, **Figure 37**). The needles should be smooth and polished with no flat spots, cracks or other damage. Inspect the bearing cage for cracks or other damage. Replace the bearing if necessary.

5. Inspect the one-way clutch rollers for uneven or excessive wear.

6. If the one-way clutch needs replacement, perform the following:

CAUTION

Do not let the jaws of the vise clamp onto the flywheel. This damages the flywheel.

a. Hold the flywheel assembly by securing the outer race in a vise with soft jaws. Protect the outer race with a rag so it is not damaged by the vise.

b. Remove the one-way clutch mounting bolts (**Figure 38**), and separate the flywheel from the one-way clutch assembly.

c. Note how the flange of the one-way clutch (4, **Figure 35**) fits in the recess of the outer race (3). Install the new one-way clutch in the same manner.

d. Remove the one-way clutch from the outer race. Install the new one-way clutch so its flange fits in the recess of the outer race.

e. Set the one-way clutch assembly into the back of the flywheel so the flange side of the one-way clutch faces in toward the flywheel.

f. Apply ThreeBond 1333B, or its equivalent, to the threads of the one-way clutch bolts, and evenly tighten the bolts.

g. Tighten the one-way clutch bolts to 16 N•m (12 ft.-lb.). Hold the rotor assembly by securing the outer race in a vise with soft jaws as described in substep a. Protect the outer race with a rag so it is not damaged by the vise.

7. Assemble the starter clutch by performing the following:

a. Place the flywheel on the workbench so the one-way clutch (**Figure 39**) faces up.

b. Set the driven gear onto the one-way clutch.

c. Press the driven gear (**Figure 36**) down while rotating it counterclockwise.

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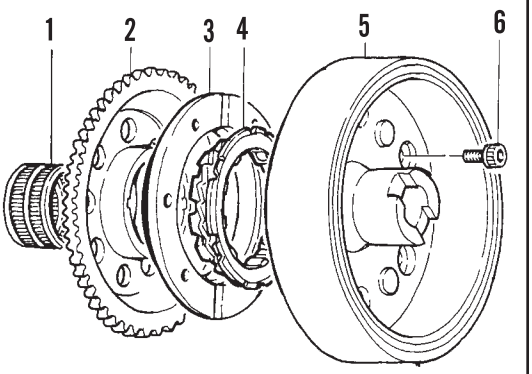
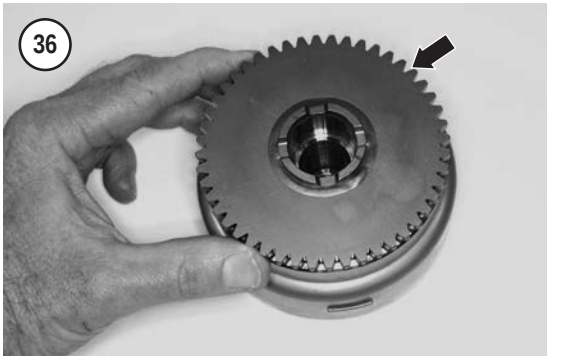
STARTER CLUTCH ASSEMBLY



1. Needle bearing
2. Starter clutch driven gear
3. Outer race
4. One-way clutch
5. Flywheel
6. One-way clutch mounting bolts

36



GEARSHIFT LINKAGE

Removal

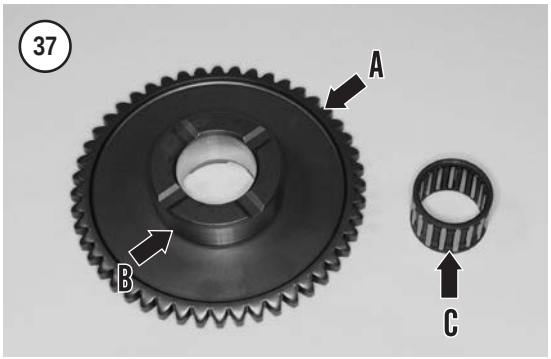
Refer to **Figure 40**.

1. Park the ATV on level ground and set the parking brake.

2. Shift the transmission into neutral.

3. Loosen the clamp bolt, and remove the shift pedal from the gearshift spindle. Note that the punch mark in the pedal aligns with the punch mark on the spindle. These marks must align during assembly.

4. Remove the alternator cover as described in this chapter.



5. Remove the clutch cover, centrifugal clutch and change clutch as described in Chapter Six.

6. Unhook the spring (A, **Figure 41**) from the gearshift plate on the front side of the crankcase, and then remove the master arm and return spring (B).

7. Remove the guide plate bolt (A, **Figure 42**) and guide plate (B).

8. Remove the gearshift plate (A, **Figure 43**), and then remove the washer (A, **Figure 44**) from the sub-gearshift spindle.

9. Pry the stopper arm away from the drum shifter (B, **Figure 44**) with a screwdriver, and remove the drum shifter and pin (C).

10. If the pin does not come out with the drum shifter, remove it from the shift drum (A, **Figure 45**).

11. Remove the bolt (B, **Figure 45**) and stopper arm (C) along with the stopper arm washer and return spring.

12. Remove the sub-gearshift spindle (**Figure 46**) and washer from the rear side of the crankcase.

13. If still in place, remove the washer (A, **Figure 22**) from the reverse stopper shaft.

14. Pry the reverse arm (A, **Figure 47**) from behind the boss on the crankcase, and remove the reverse stopper shaft (B).

15. If necessary, remove the gearshift A-arm (A, **Figure 48**) from the alternator cover by performing the following:

a. Bend the lock tab (B, **Figure 48**) away from the bolt flat, and remove the bolt from the gearshift A-arm.
b. Slide the gearshift spindle (C, **Figure 48**) from the gearshift A-arm.
c. Remove the gearshift A-arm and its washers from the alternator cover.
d. Discard the lockwasher. A new one must be installed during assembly.

Installation

1. Slide the reverse stopper shaft into place in the crankcase so the reverse arm (A, **Figure 47**) sits behind the boss in the crankcase. Make sure the spring tang (C, **Figure 47**) engages the stiffening rib in the crankcase.

2. Install the washer (A, **Figure 22**) onto the reverse stopper shaft.

3. Install the washer (A, **Figure 49**) onto the sub-gearshift spindle, and slide it up against the snap ring (B).

4. Slide the sub-gearshift spindle (**Figure 46**) into the crankcase until it bottoms.

5. If the gearshift-A arm was removed from the alternator cover, install it by performing the following:

a. Pack the gearshift-spindle seal (**Figure 50**) in the cover with lithium grease.

NOTE

The washer with the tabs sits on the pin side of the A-arm. Refer to ***Figure 40****.*

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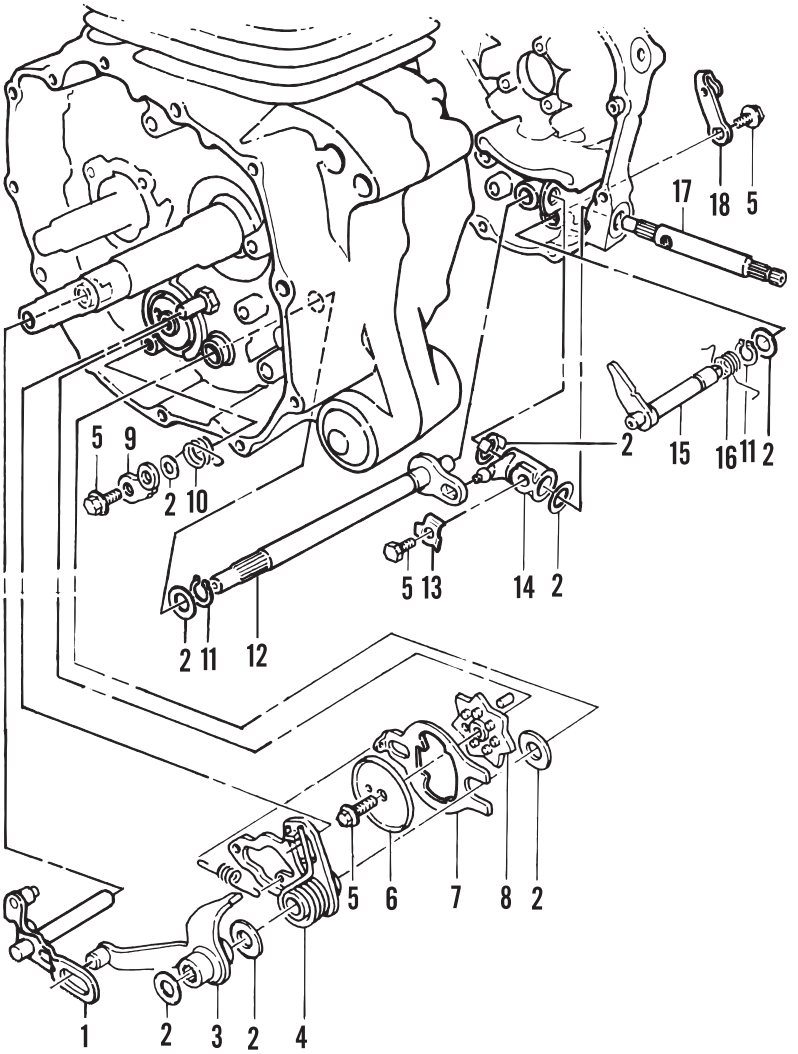
GEARSHIFT ASSEMBLY

1. Clutch lever
2. Washer
3. Sub-gearshift spindle arm
4. Master arm
5. Bolt
6. Guide plate
7. Gearshift plate
8. Drum shifter
9. Stopper arm
10. Spring
11. Snap ring
12. Sub-gearshift spindle
13. Lockwasher
14. Gearshift A-arm
15. Reverse stopper shaft
16. Spring
17. Gearshift spindle
18. Reverse stopper lever



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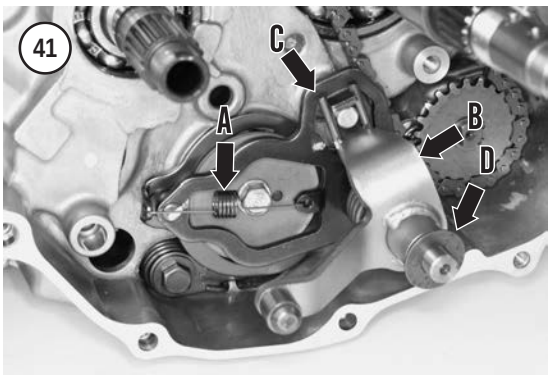

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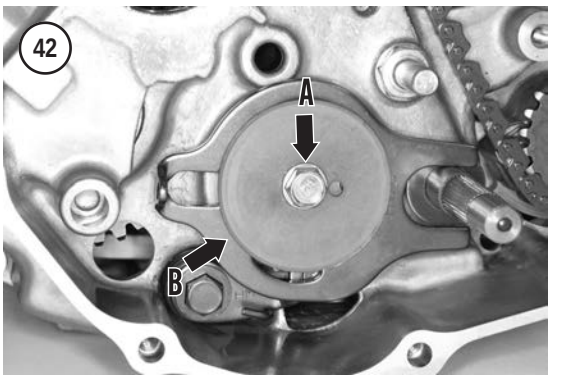
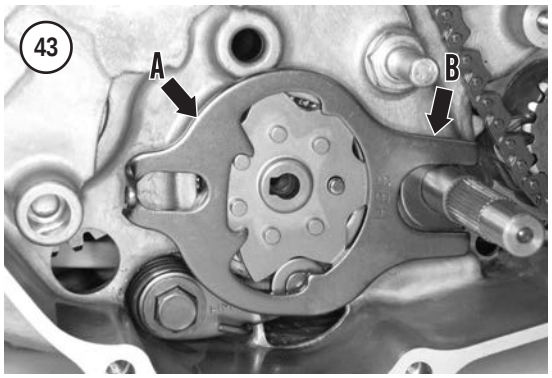
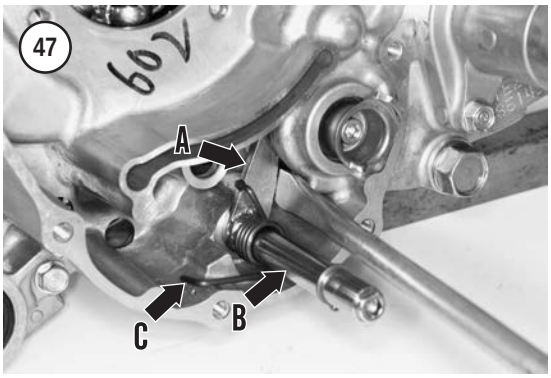
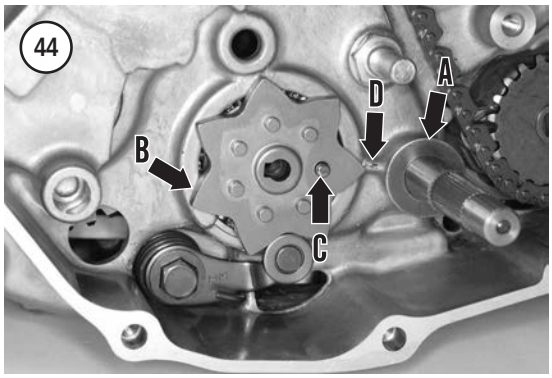
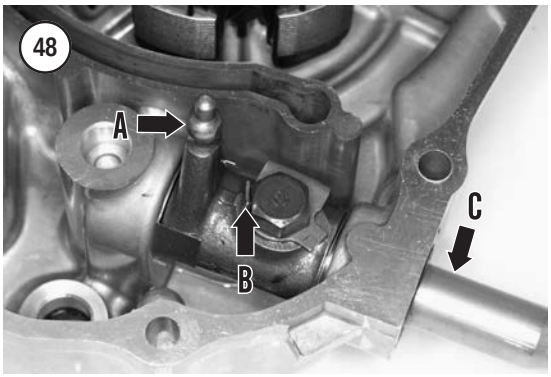
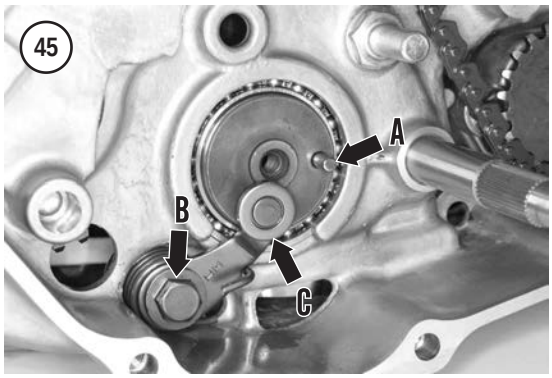


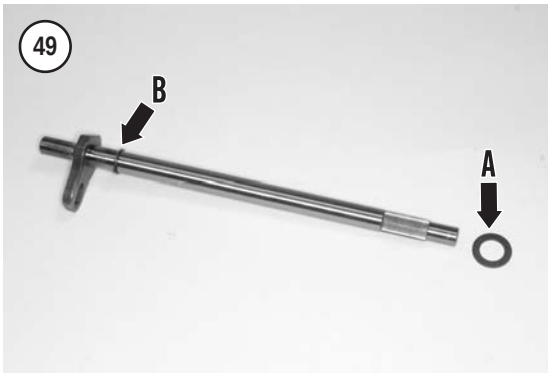












b. Make sure the washers are in place on either side of the A-arm, and set the gearshift A-arm (A, **Figure 48**) into place in the alternator cover.
c. Align the master splines on the gearshift spindle with those of the gearshift A-arm, and install the gearshift spindle (C, **Figure 48**) through the seal and into the A-arm.
d. Apply ThreeBond 1333B, or its equivalent, to the threads of the gearshift A-arm bolt, and install the bolt with a new lockwasher.
e. Tighten the gearshift A-arm bolt to 25 N•m (18 ft.-lb.), and bend a lock tab against a bolt flat (B, **Figure 48**).
f. Pivot the gearshift spindle to make sure it moves smoothly with no binding or roughness.

6. Install the stopper arm by performing the following:
a. Install the stopper arm bolt through the mounting hole in the stopper arm, and then install the washer onto the bolt.
b. Hook the return spring onto the stopper arm.
c. Apply ThreeBond 1333B, or its equivalent, to the threads of the stopper arm bolt.
d. Fit the stopper arm into place in the crankcase, and tighten the bolt (B, **Figure 45**) to 12 N•m (106 in.-lb.). Make sure the return spring hooks around the stopper arm.
e. Press the stopper arm down, and release it. It must move under spring pressure with no binding.

NOTE

If the stopper arm does not move, the bolt is not centered through the stopper arm, washer or spring. Loosen the bolt, and reinstall it.

7. Install the pin (A, **Figure 45**) into the shift drum.
8. Press the stopper arm with a screwdriver, and install the drum shifter (B, **Figure 44**) onto the shift drum. Make sure the drum shifter engages the pin (C, **Figure 44**) in the shift drum.

NOTE

*The transmission is in neutral when the pin (C, **Figure 44**) aligns with indexing mark on the crankcase (D).*

9. Install the washer (A, **Figure 44**) onto the end of the sub-gearshift spindle.

10. Install the gearshift plate so its arms (B, **Figure 43**) straddle the sub-gearshift spindle.

11. Install the gearshift plate (B, **Figure 42**). Apply ThreeBond 1333B to the threads of the guide plate bolt (A, **Figure 42**), and tighten the bolt to 16 N•m (12 ft.-lb.).

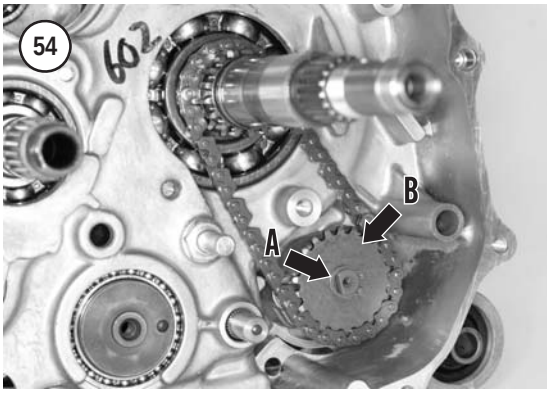
12. Slide the master arm (B, **Figure 41**) onto the sub-gearshift spindle so the arms of the spring (C) straddle the stopper bolt, and then install the washer (D).

13. Hook the return spring (A, **Figure 41**) to the master arm and gearshift plate.

14. Install the change clutch, centrifugal clutch and the clutch cover as described in Chapter Six.

15. Install the alternator cover as described in this chapter.

16. If the engine is installed in the frame, install the shift pedal onto the gearshift spindle. Make sure the punch mark on the pedal aligns with the punch mark on the spindle. Tighten the shift pedal clamp bolt to 20 N•m (14 ft.-lb.).



Inspection

Replace parts that show excessive wear or damage as described in this section.

1. Clean and dry all parts.
2. Check the splines on the master arm, sub-gearshift spindle and gearshift spindle.
3. Check the sub-gearshift spindle and the gearshift spindle for bending or other damage.
4. Check the snap ring groove in the sub-gearshift spindle for cracks or damage. If the snap ring is removed (B, **Figure 49**), install a new one during assembly.
5. Check the drum shifter for wear, cracks or other damage.
6. Check the stopper arm assembly (**Figure 51**) for:
   a. Damaged stopper arm.
   b. Worn or damaged roller.
   c. Weak or damaged return spring.
7. Check the master arm assembly (**Figure 52**) for:
   a. Damaged master arm.
   b. Weak or damaged return spring.
8. Check the gearshift spindle dust seal in the alternator cover. Replace the seal if it is brittle or showing signs of leaking. Refer to Chapter One. Install the seal with the manufacturer's marks facing out.
9. Inspect the reverse stopper shaft (**Figure 53**) for:
   a. Weak or damaged spring.
   b. Bent or damaged reverse shaft.
   c. Damaged snap ring groove.
   d. To replace the spring, remove the snap ring and spring. Install the spring over the reverse stopper shaft as shown in **Figure 53**. Install a new snap ring.

5

OIL PUMP

The oil pump assembly is mounted on the clutch side of the engine. The oil pump can be removed with the engine mounted in the frame. The following steps are shown with the engine removed for clarity.

Removal/Installation

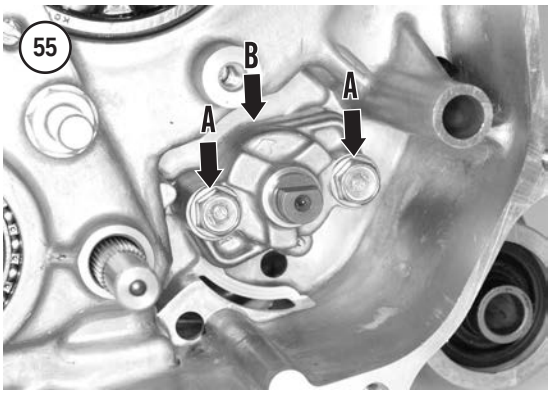
1. Remove the clutch cover and the centrifugal clutch as described in this chapter.

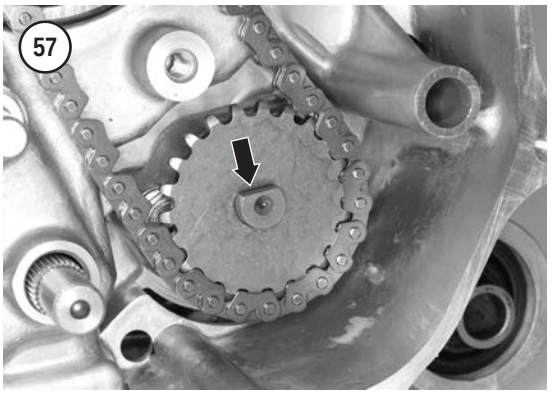
NOTE

The oil pump can be removed and installed with the cam chain mounted on the engine. Do not perform Step 2 unless the oil pump chain must be serviced.

2. If the oil pump chain requires service, set the engine to top dead center and remove the cam chain tensioner, tensioner arm and cam chain as described in Chapter Four.
3. Remove the snap ring (A, **Figure 54**) from the end of the pump shaft, and remove the oil pump sprocket (B).
4. Remove the oil pump bolts (A, **Figure 55**), and pull the oil pump assembly (B) from the crankcase.
5. Remove the dowels (**Figure 56**) from the crankcase.
6. If the oil pump is not going to be serviced, store it in a plastic bag.
7. Service the oil pump as described in this section.
8. Install the oil pump by reversing these removal steps, plus the following:
   a. Make sure the oil pump engages the dowels (**Figure 56**) in the crankcase.

b. Install the oil pump sprocket so the flat on the mounting hole engages the boss on the oil pump shaft. Refer to **Figure 57**.
c. Make sure the oil pump chain properly engages the oil pump sprocket and the oil pump drive sprocket on the crankshaft.
d. Check pump engagement by turning the crankshaft back and forth. When doing so, the pump shaft (visible on the outside of the pump) should turn.





Disassembly

Refer to **Figure 58**.

1. If still installed, remove the dowels (A, **Figure 59**) from the pump side plate.
2. Remove the E-clip (B, **Figure 59**) and washer (C) from the pump shaft.

CAUTION

The oil pump screw is very tight. Loosen the screw with a hand impact driver and No. 2 Phillips bit. If the head is damaged, the screw must be drilled out.

3. Use an impact driver to loosen the oil pump screw (D, **Figure 59**), and then remove the screw from the pump body. Remove the side plate from the pump body.

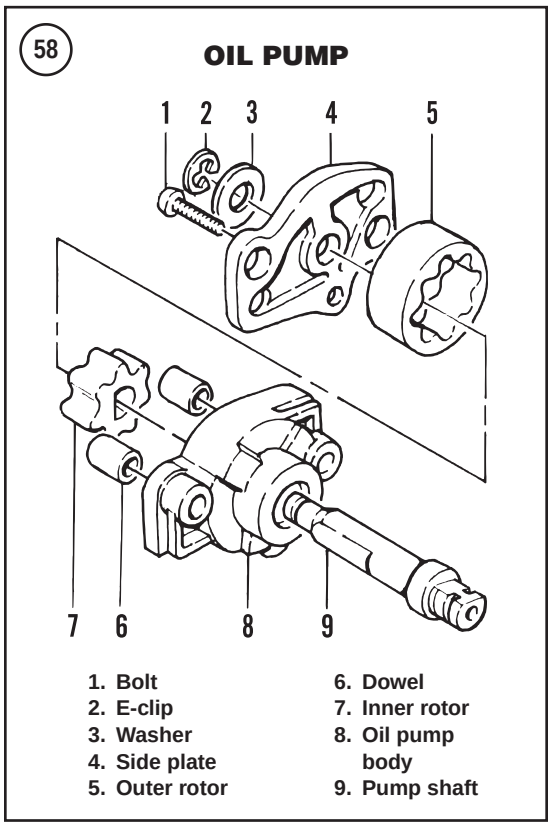
NOTE

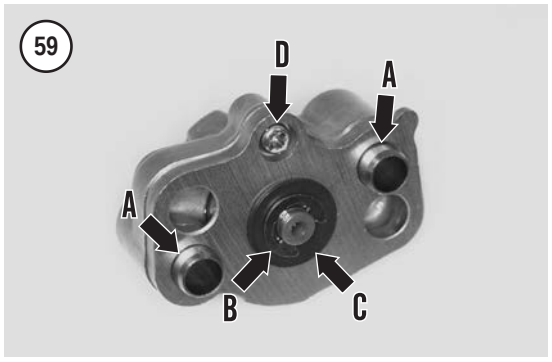
If the rotors are not marked, mark their up sides so the rotors can be reinstalled with the same side facing out toward the side plate.

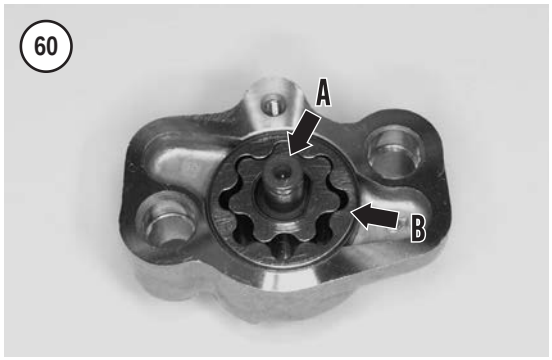
4. Remove the pump shaft (A, **Figure 60**) and both rotors (B).
5. Inspect the oil pump assembly (**Figure 61**) as described in this section.

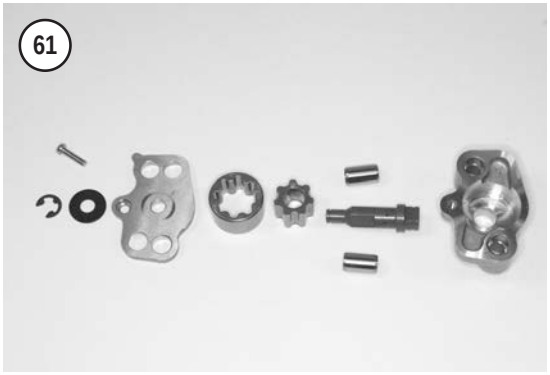
Assembly

1. If necessary, clean the parts again as described in this section. Lubricate the rotors and body rotor bore with fresh engine oil when installing them in the following steps.
2. Install the outer and inner rotors (B, **Figure 60**). If installing the original rotors, install them with their marked sides facing up as noted during disassembly.
3. Install the pump shaft (A, **Figure 60**).
4. Install the dowels (A, **Figure 59**) and the side plate.
5. Install the washer (C, **Figure 59**) and the screw (D). Finger-tighten the screw.
6. Install the E-clip (B, **Figure 59**) with its chamfered side facing the washer. Make sure the clip is completely seated in the pump shaft groove.
7. Tighten the screw securely.









8. Turn the pump shaft. If there is any roughness or binding, disassemble the oil pump and check it for damage.
9. Store the oil pump in a plastic bag until installation.

Cleaning and Inspection

An excessively worn or damaged oil pump does not maintain oil pressure and should be repaired or replaced before it causes engine damage. Inspect the oil pump carefully when troubleshooting a lubrication or oil pressure problem.

Refer to **Figure 58** when inspecting the oil pump components in this section. Replace parts that are out of specification or damaged.

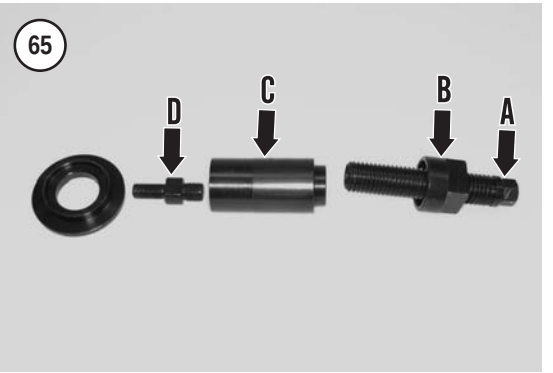
1. Clean and dry all parts. Place the parts on a clean, lint-free cloth.
2. Check the pump shaft for scoring, cracks or signs of heat discoloration. Check the E-clip groove for damage.
3. Check the oil pump body for:
   a. Warped or cracked mating surfaces.
   b. Rotor bore damage.
4. Check the oil pump rotors for:
   a. Cracked or damaged outer surface.
   b. Worn or scored inner mating surfaces.
5. If the oil pump side plate, body and both rotors are in good condition, check their operating clearances as described in Step 6 and Step 7.

NOTE

The pump rotors are sold separately. The pump body, pump shaft and side plate are not.

6. Install the inner and outer rotors (B, **Figure 60**) and pump shaft (A) into the pump body.

7. Using a flat feeler gauge, measure the clearance between the outer rotor and the oil pump body (**Figure 62**). If the oil pump body clearance exceeds the service limit, replace the outer rotor and remeasure. If it is still out of specification, replace the oil pump assembly.
8. Using a flat feeler gauge, measure the clearance between the inner rotor tip and the outer rotor (**Figure 63**). If the oil pump tip clearance exceeds the service limit, replace the inner and outer rotors.
9. Using a flat feeler gauge and straightedge, measure the side clearance between the body surface and rotors (**Figure 64**). If the oil pump side clearance exceeds the service limit, replace the oil pump assembly.



CRANKCASE AND CRANKSHAFT

The crankcase is made in two halves of thin-wall, precision diecast aluminum alloy. To avoid damage, do not hammer or pry on any of the interior or exterior projected walls. A gasket seals the crankcase mating surfaces while dowels align the halves when they are bolted together. A crankcase half can be replaced separately.

The crankshaft assembly consists of two full-circle flywheels pressed together on a crankpin. Two ball bearings in the crankcase support the crankshaft assembly.

The procedure which follows is presented as a complete, step-by-step major lower end overhaul. If only servicing the transmission, disassemble and reassemble the crankcase without removing the crankshaft.

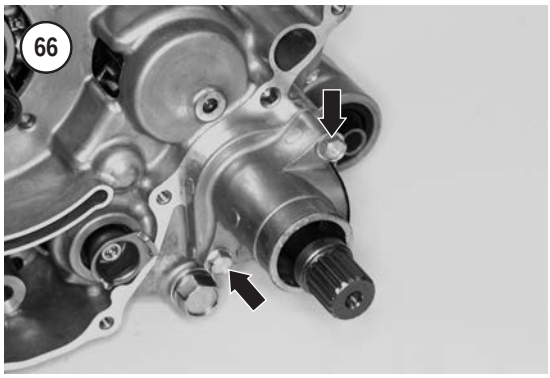
An oil screen and oil strainer are installed inside the crankcase. Thoroughly clean these parts whenever the crankcase halves are separated.

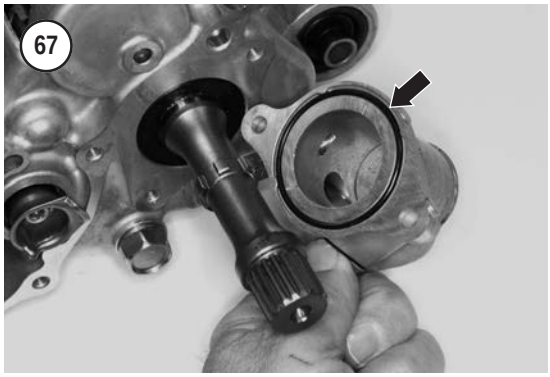
References to the front and rear sides of the engine refer to the engine in the frame, not how it may sit on the workbench.

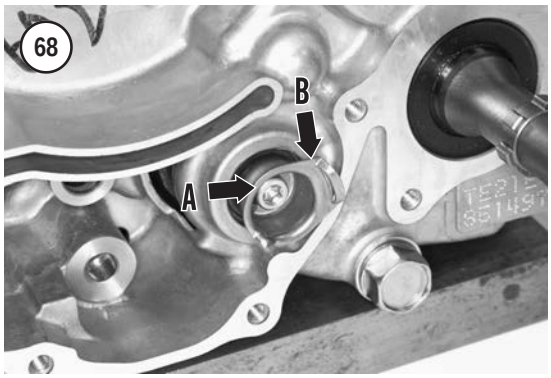
Tools

The following Honda tools are required to install the crankshaft into the rear crankcase half. Have these tools or their equivalent on hand if removing the crankshaft.

1. Assembly shaft (A, **Figure 65**): part No. 07965-VM00200 or 07931-ME4010B.







2. Special nut (B, **Figure 65**): part No. 07931-HB3020A.
3. Assembly collar (C, **Figure 65**): part No. 07965-VM00100.
4. Threaded adapter (D, **Figure 65**): part No. 07965- KA30000 or 07VMF-HM8010A.

Crankcase Disassembly

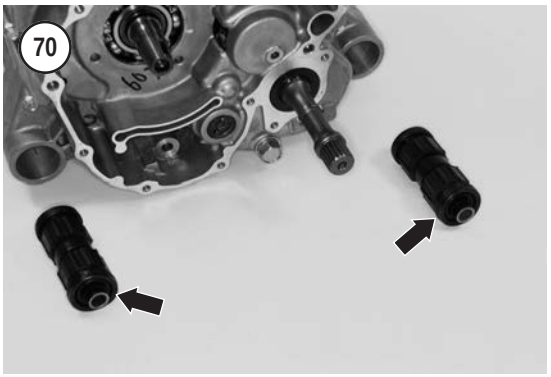
This procedure describes disassembly of the crankcase halves and removal of the transmission and internal shift mechanism. Crankshaft removal is covered in a separate procedure in this section. Refer to Chapter Seven for transmission and internal shift mechanism service.

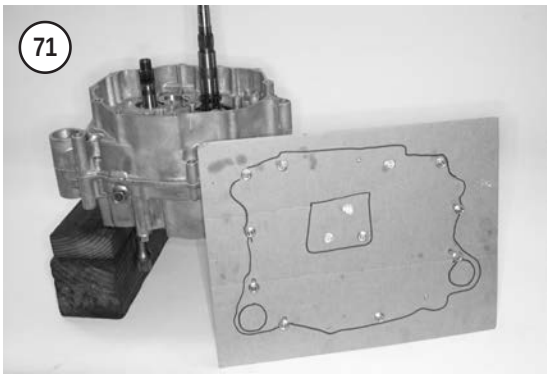
1. Remove all exterior engine assemblies as described in this chapter and other related chapters:
   a. Cylinder head, cylinder and piston (Chapter Four).
   b. Remove the centrifugal and change clutch (Chapter Six).
   c. Oil cooler.
   d. Flywheel and starter clutch.
   e. Starter (Chapter Nine).
   f. Gearshift linkage.
   g. Oil pump.
2. Remove the engine from the frame as described in this chapter. Set it on wooden blocks.
3. Remove the mounting bolts (**Figure 66**) and remove the countershaft protector and its O-ring (**Figure 67**).
4. Remove the mounting bolt (A, **Figure 68**), and remove the neutral switch rotor (B) from the shift drum.
5. Remove the damping rubber from each engine hanger (**Figure 69**), and drive out each hanger bushing (**Figure 70**).

NOTE

*To prevent loss and to ensure proper bolt location during assembly, draw the crankcase outline on cardboard (**Figure 71**). Punch holes into this template that correspond to bolt locations. Insert the crankcase bolts in their appropriate locations after removing them.*

6. Loosen and remove the three front crankcase bolts (**Figure 72**), and place them in the cardboard template.





7. Turn the engine over so the rear side faces up.
8. Evenly loosen each rear crankcase mounting bolts (**Figure 72**) 1/4 turn and in a crisscross pattern. Repeat this until all the mounting bolts are loose.
9. Remove all the bolts loosened in Step 8, and set them in the cardboard template. Make sure to remove all the crankcase mounting bolts.
10. Turn the engine over so the front side (**Figure 73**) faces up.

CAUTION

Perform this operation over and close to the work bench because the crankcase halves may easily separate. Do ***not*** *hammer directly on the crankcase halves. This damages the case halves.*

CAUTION

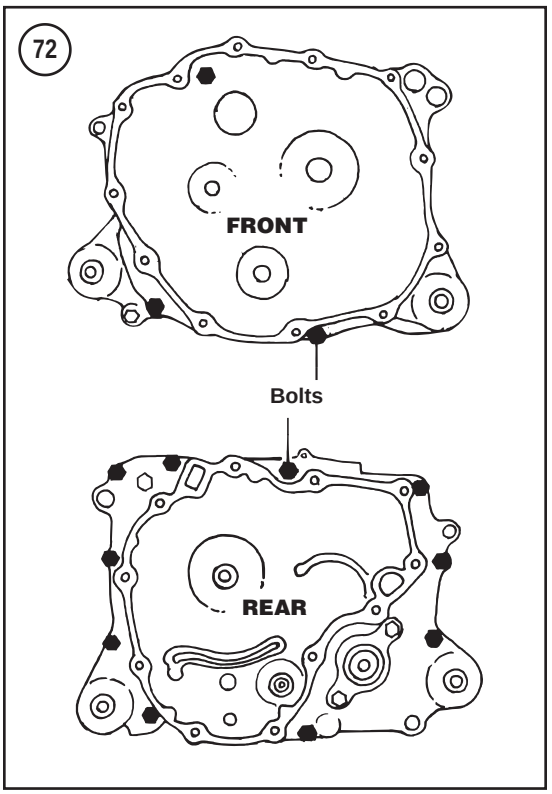
Do not pry between the crankcase mating surfaces when separating the crankcase halves. Doing so may cause an oil leak.

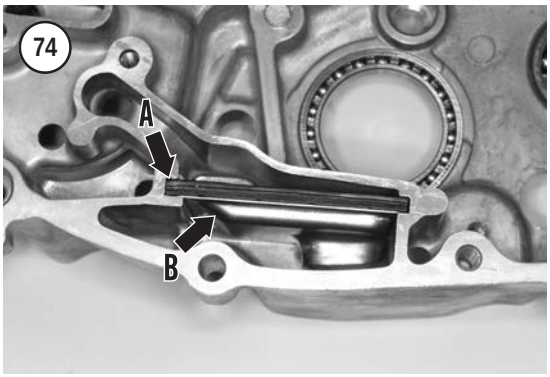
11. Tap on the front crankcase while lifting it off the engine. Tap the transmission shafts if they bind with the crankcase and prevent disassembly. Lift the front crankcase from the rear case.

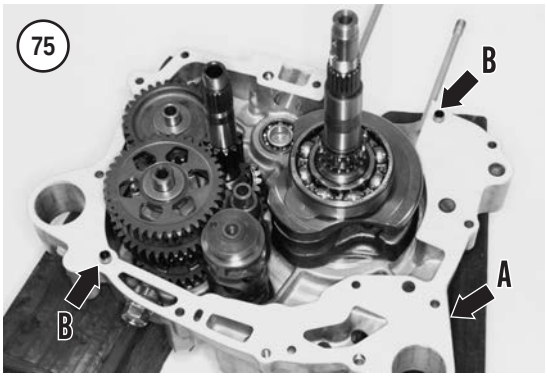
NOTE

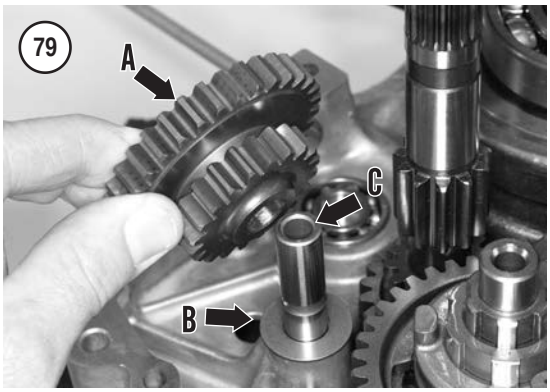
The oil screen is not quite rectangular. One side is narrower than the other. Note how the narrow side fits in toward the front crankcase half. It must be reinstalled with this same orientation during assembly.

12. Simultaneously slide the oil screen (A, **Figure 74**) and the oil strainer (B) from the inside of the front crankcase half.









13. Remove the gasket (A, **Figure 75**) and dowels (B) from the rear crankcase.

NOTE
Steps 14-17 describe removal of the transmission.

14. Remove the thrust washer (A, **Figure 76**), countershaft first gear (B) and first gear bushing (**Figure 77**) from the countershaft.

15. Remove the thrust washer (**Figure 78**) and the reverse idle gear (A, **Figure 79**) from the reverse idle shaft.

16. Remove the second thrust washer (B, **Figure 79**) and reverse idler shaft (C).

17. Grasp the mainshaft (A, **Figure 80**), countershaft (B) and shift drum/shift fork (C) assemblies together, and remove all three assemblies from the rear crankcase half as a single unit.

NOTE
Steps 18-20 describe crankshaft removal.

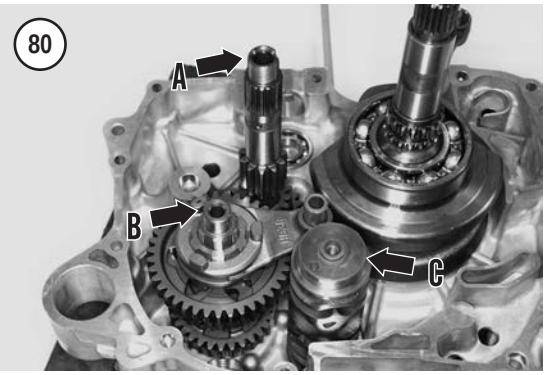
18. Install the threaded adapter onto the rear of the crankshaft (**Figure 81**).

19. Set the rear crankcase half into a press, and press the crankshaft from the case half.

CAUTION

The rear crankshaft bearing must be replaced whenever the crankshaft is removed.

20. Remove the rear crankcase bearing as described in this section.



Crankcase Assembly

1. Install the rear crankshaft bearing into the rear crankcase half as described in this section.

2. Install the crankshaft into the rear crankshaft bearing by performing the following:

a. Apply engine oil to the bearing and to the crankshaft bearing journal.

b. Slide the crankshaft through the bearing until the bearing journal bottoms against the bearing inner race.

c. Use a rubber band to support the connecting rod in an upright position as shown in **Figure 82**.

d. Install the threaded adapter onto the rear crankshaft end (**Figure 81**).

e. Slide the assembly collar (A, **Figure 83**) over the crankshaft, and seat it against the bearing.

f. Thread the special nut (B, **Figure 83**) down onto the assembly shaft (C).

g. Slide the assembly shaft into the assembly collar and thread it onto the threaded adapter on the crankshaft end. Run the special nut down against the assembly collar.

h. Hold the special nut (B, **Figure 83**) and turn the assembly shaft (C) to pull the crankshaft into the bearing. Frequently check that the crankshaft is going straight into the bearing and not binding to one side.

i. Turn the assembly shaft until the crankshaft is pulled into the bearing. Remove the tool and check the operation of the crankshaft. It must turn smoothly.

3. Set the rear crankcase half onto wooden blocks (**Figure 84**).